atlas_conf_2013_049 Validation

2 opposite-sign leptons, 0 jets + E_T^{miss}, [1]
Energy: 8 TeV
Luminosity: 20.3 fb^{-1}
Validation notes:

- Validation has been performed versus all published cutflows, see Tables 1 to 5.
  - The Monte-Carlo generator was Herwig++ 2.5.2 [2].
  - Cross-sections calculated with Prospino 2 [3]
- Jet veto conditions have been tightened by 25% compared to the corresponding stated ATLAS values. This was done to match cutflow values and we believe that this is due to pile-up effects that CheckMATE does not currently simulate.
- WARNING: For simplified models with chargino production and weak boson mediated decay, CheckMATE systematically underestimates signal region cutflows. Despite much effort, no reason for this discrepancy has been found. The corresponding setting is conservative since it will not lead to spurious model exclusion.
- Trigger efficiencies are not given as detailed functions of p_T and η so conservative settings are chosen.
  - Symmetric di-electron trigger, $p_T(e_2) > 14$ GeV, 98% efficient.
  - Asymmetric di-electron trigger, $p_T(e_1) > 25$ GeV, $p_T(e_2) > 10$ GeV 85% efficient.
  - Symmetric di-muon trigger, $p_T(\mu_2) > 14$ GeV, 52% efficient.
  - Asymmetric di-muon trigger, $p_T(\mu_1) > 18$ GeV, $p_T(\mu_2) > 10$ GeV 80% efficient.
  - Mixed electron-muon trigger A, $p_T(e) > 14$ GeV, $p_T(\mu) > 10$ GeV 65% efficient.
  - Mixed electron-muon trigger B, $p_T(e) > 10$ GeV, $p_T(\mu) > 18$ GeV 65% efficient.

Process	$\tilde{\ell}^+\tilde{\ell}^-$ production			
Point	$m(\tilde{\ell}_L) = m(\tilde{\ell}_R) = 191$ GeV, $m(\tilde{\chi}_1^0) = 90$ GeV			
	e^+e^-		$\mu^+\mu^-$	
Source	ATLAS	C.M.	ATLAS	C.M.
Generated events	5000	50000	5000	50000
Trigger	150 ± 3	153 ± 1	159 ± 3	153 ± 1
$e^\pm\mu^\pm$	139 ± 3	143 ± 1	148 ± 3	142 ± 1
Jet veto	58 ± 2	62 ± 1	62 ± 2	61 ± 1
$(p_{\mathrm{T}}^{\ell 1}, p_{\mathrm{T}}^{\ell 2}) > (35, 20)$ GeV	45 ± 2	47 ± 1	50 ± 2	47 ± 1
SR-$m_{T2,90}$	21.6 ± 1.1	20.9 ± 0.4	21.6 ± 1.1	20.6 ± 0.4
SR-$m_{T2,110}$	12.3 ± 0.9	11.6 ± 0.3	12.0 ± 0.8	11.8 ± 0.3

Table 1: Cutflow validation for atlas_conf_2013_049, testing slepton pair production. Shown are the number of events after each selection cut, normalised to 20.7 fb^{-1}. Final error is from Monte Carlo statistics for both ATLAS and CheckMATE.

Process	$\tilde{\ell}^+\tilde{\ell}^-$ production			
Point	$m(\tilde{\ell}_L) = m(\tilde{\ell}_R) = 250$ GeV, $m(\tilde{\chi}_1^0) = 10$ GeV			
	e^+e^-		$\mu^+\mu^-$	
Source	ATLAS	C.M.	ATLAS	C.M.
Generated events	5000	50000	5000	50000
Trigger	55 ± 1	55 ± 0	50 ± 1	50 ± 0
$e^\pm\mu^\pm$	54 ± 1	52 ± 0	49 ± 1	48 ± 0
Jet veto	20 ± 1	22 ± 0	20 ± 1	21 ± 0
$(p_{\mathrm{T}}^{\ell 1}, p_{\mathrm{T}}^{\ell 2}) > (35, 20)$ GeV	17 ± 1	19 ± 0	17 ± 1	18 ± 0
SR-$m_{T2,90}$	12.2 ± 0.5	12.3 ± 0.2	12.5 ± 0.5	12.8 ± 0.2
SR-$m_{T2,110}$	10.5 ± 0.4	10.0 ± 0.1	11.2 ± 0.5	11.0 ± 0.1

Table 2: Cutflow validation for atlas_conf_2013_049, testing slepton pair production. Shown are the number of events after each selection cut, normalised to 20.7 fb^{-1}. Final error is from Monte Carlo statistics for both ATLAS and CheckMATE.

Process	$\tilde{\chi}^+\tilde{\chi}^-$ production, slepton decay					
Point	$m(\tilde{\chi}^\pm) = 350$ GeV $m(\tilde{\ell_L}) = m(\tilde{\nu}) = 175$ GeV $m(\tilde{\chi}_1^0) = 0$ GeV					
	e^+e^-		$\mu^+\mu^-$		$e^\pm\mu^\mp$	
Source	ATLAS	C.–MATE	ATLAS	C.–MATE	ATLAS	C.–MATE
Generated events	40000	50000	40000	50000	40000	50000
Trigger	52 ± 1	50 ± 1	48 ± 1	49 ± 1	79 ± 1	74 ± 1
$e^\pm\mu^\pm$	48 ± 1	47 ± 1	45 ± 1	46 ± 1	74 ± 1	69 ± 1
Jet veto	20 ± 1	20 ± 0	19 ± 1	20 ± 0	30 ± 1	29 ± 1
$(p_{\mathrm{T}}^{\ell 1}, p_{\mathrm{T}}^{\ell 2}) > (35, 20)$ GeV	17 ± 1	17 ± 0	17 ± 1	17 ± 0	25 ± 1	25 ± 1
SR-$m_{T2,90}$	11.7 ± 0.4	11.4 ± 0.3	10.5 ± 0.4	10.6 ± 0.3	16.6 ± 0.5	16.4 ± 0.4
SR-$m_{T2,110}$	9.5 ± 0.4	9.4 ± 0.3	8.7 ± 0.4	8.7 ± 0.3	14.0 ± 0.5	13.5 ± 0.4

Table 3: Cutflow validation for atlas_conf_2013_049, testing chargino pair production with extra decay into sleptons, assuming a massless lightest neutralino. Shown are the number of events after each selection cut, normalised to 20.7 fb^{-1}. Final error is from Monte Carlo statistics for both ATLAS and CheckMATE.

Process	$\tilde{\chi}^+\tilde{\chi}^-$ production, slepton decay					
Point	$m(\tilde{\chi}^\pm) = 425$ GeV $m(\tilde{\ell_L}) = m(\tilde{\nu}) = 212.5$ GeV $m(\tilde{\chi}_1^0) = 75$ GeV					
	e^+e^-		$\mu^+\mu^-$		$e^\pm\mu^\mp$	
Source	ATLAS	C.–MATE	ATLAS	C.–MATE	ATLAS	C.–MATE
Generated events	40000	50000	40000	50000	40000	50000
Trigger	20 ± 0	21 ± 0	20 ± 0	20 ± 0	31 ± 0	30 ± 0
$e^\pm\mu^\pm$	19 ± 0	20 ± 0	19 ± 0	19 ± 0	29 ± 0	28 ± 0
Jet veto	7 ± 0	8 ± 0	7 ± 0	8 ± 0	11 ± 0	11 ± 0
$(p_{\mathrm{T}}^{\ell 1}, p_{\mathrm{T}}^{\ell 2}) > (35, 20)$ GeV	6 ± 0	7 ± 0	6 ± 0	7 ± 0	9 ± 0	10 ± 0
SR-$m_{T2,90}$	4.3 ± 0.1	4.9 ± 0.1	4.4 ± 0.1	4.6 ± 0.1	6.7 ± 0.2	7.0 ± 0.2
SR-$m_{T2,110}$	3.7 ± 0.1	4.3 ± 0.1	3.8 ± 0.1	3.9 ± 0.1	5.7 ± 0.2	5.9 ± 0.2

Table 4: Cutflow validation for atlas_conf_2013_049, testing chargino pair production with extra decay step into sleptons, assuming a massive lightest neutralino. Shown are the number of events after each selection cut, normalised to 20.7 fb^{-1}. Final error is from Monte Carlo statistics for both ATLAS and CheckMATE.

Process	$\tilde{\chi}^+\tilde{\chi}^-$ production, WW decay					
Point	$m(\tilde{\chi}_1^\pm) = 100$ GeV $m(\tilde{\chi}_1^0) = 0$ GeV		$m(\tilde{\chi}_1^\pm) = 140$ GeV $m(\tilde{\chi}_1^0) = 20$ GeV		$m(\tilde{\chi}_1^\pm) = 200$ GeV $m(\tilde{\chi}_1^0) = 0$ GeV	
Source	ATLAS	C.–MATE	ATLAS	C.–MATE	ATLAS	C.–MATE
Generated events	20000	50000	20000	50000	20000	50000
No Cuts	11003	-	3393	-	749	-
All Cleaning *	10691 ± 76	10673 ± 53	3299 ± 24	3289 ± 16	732 ± 6	727 ± 3
Two signal leptons	3178 ± 41	2610 ± 26	1060 ± 14	898 ± 9	261 ± 4	218 ± 2
Trigger	2559 ± 37	1977 ± 23	872 ± 12	684 ± 7	214 ± 3	167 ± 2
$e^\pm\mu^\pm$	861 ± 21	803 ± 15	296 ± 7	288 ± 5	71 ± 2	69 ± 1
Jet veto	443 ± 15	437 ± 11	139 ± 5	152 ± 4	31 ± 1	34 ± 1
$(p_{\mathrm{T}}^{\ell 1}, p_{\mathrm{T}}^{\ell 2}) > (35, 20)$ GeV	310 ± 13	302 ± 9.9	103 ± 4	111 ± 3	25 ± 1	27 ± 1
SR-WWa	31.5 ± 4.1	21.6 ± 2.4	-	-	-	-
SR-WWb	-	-	8.2 ± 1.2	4.5 ± 0.6	-	-
SR-WWc	-	-	-	-	3.3 ± 0.4	2.6 ± 0.2

Table 5: Cutflow validation for atlas_conf_2013_049, testing chargino pair production with extra decay step into W bosons. Shown are the number of events after each selection cut, normalised to 20.7 fb^{-1}. Final error is from Monte Carlo statistics for both ATLAS and CheckMATE. **No cleaning cuts are performed by CheckMATE, instead a flat efficiency factor is applied to simulate this effect.*

References

[1] Search for direct-slepton and direct-chargino production in final states with two opposite-sign leptons, missing transverse momentum and no jets in 20/fb of pp collisions at sqrt(s) = 8 tev with the atlas detector, Tech. Rep. ATLAS-CONF-2013-049, CERN, Geneva (May 2013).

[2] M. Bahr, S. Gieseke, M. Gigg, D. Grellscheid, K. Hamilton, et al., Herwig++ Physics and Manual, Eur.Phys.J. C58 (2008) 639–707. arXiv:0803.0883, doi:10.1140/epjc/s10052-008-0798-9.

[3] W. Beenakker, M. Klasen, M. Kramer, T. Plehn, M. Spira, et al., The Production of charginos / neutralinos and sleptons at hadron colliders, Phys.Rev.Lett. 83 (1999) 3780–3783. arXiv:hep-ph/9906298, doi:10.1103/PhysRevLett.100.029901, 10.1103/PhysRevLett.83.3780.